Claims

1. Solid ion conductor, characterized in that it has a garnet-like crystal structure and that it has a higher ion conductivity than $3.4x10^{-6}$ S/cm.

2. Solid ion conductor, characterized in that it has a garnet-like crystal structure and that it has a stoichiometric composition which is formally derived by aliovalent substitution of $Li_5La_3M_2O_{12}$ in which M is Nb or Ta.

3. Solid ion conductor, characterized in that it has a garnet-like crystal structure and that it has a stoichiometric composition $L_{5+x}A_yG_zM_2O_{12}$, wherein
L is in each case independently an arbitrary preferably monovalent cation,
A is in each case independently a monovalent, divalent, trivalent or tetravalent cation,
G is in each case independently a monovalent, divalent, trivalent or tetravalent cation
M is in each case independently a trivalent, tetravalent or pentavalent cation,
$0 < x \leq 2$, $0 \leq y \leq 3$, $0 \leq z \leq 3$ and
wherein O can be partially or completely replaced by divalent and/or trivalent anions such as e.g. N^{3-}.

4. Solid ion conductor as claimed in any of the previous claims, wherein the stoichiometric composition is

$$L_{5+x}A_xG_{3-x}M_2O_{12}$$

and wherein
$0 < x \leq 1$,
L is a monovalent alkali metal cation,
A is a divalent metal cation,

G is a trivalent cation and

M is a pentavalent cation.

5. Solid ion conductor as claimed in claim 3 or 4, wherein L is selected from Li, Na and K can in each case be the same or different.

6. Solid ion conductor as claimed in claim 5, wherein L is Li.

7. Solid ion conductor as claimed in one of the claims 3 to 6, wherein A is selected from divalent cations preferably alkaline earth metal ions.

8. Solid ion conductor as claimed in any of claims 3 to 7, wherein M is selected from transition metal ions.

9. Solid ion conductor as claimed in any of claims 3 to 8, wherein A is selected from Ca, Sr and/or Ba and wherein M is selected from Nb and Ta.

10. Solid ion conductor as claimed in claim 8 or 9, wherein A is selected from Sr and Ba and wherein M is Ta.

11. Solid ion conductor as claimed in any of claims 3 to 10, characterized in that it is stable towards elemental lithium at lithium activities corresponding to a voltage of 5 V.

12. Process for producing a solid ion conductor as claimed in one of the previous claims, characterized in that salts and/or oxides of L, A, G and M are reacted together.

13. Process as claimed in claim 12, characterized in that the reaction takes place in a solid phase reaction.

14. Process as claimed in any of claims 12 or 13 for the production of a solid ion conductor as claimed in claim 4, characterized in that L and A are used in the form of nitrates, carbonates or hydroxides and are reacted with G_2O_3 and M_2O_5.

15. Process as claimed in any of claims 12 to 14, which comprises the following steps:
(a) mixing the starting materials and ball-milling, preferably using zirconium oxide balls in 2-propanol,
(b) heating the mixture from (a) in air for 2-10 h to 400-1000°C;
(c) ball-milling, preferably using zirconium balls in 2-propanol;
(d) pressing the mixture with isostatic pressure into pellets; and
(e) sintering the pellets covered with a powder of the same composition for 10-50 h at 700-1200°C.

16. Process as claimed in claim 15, wherein
in step (b) the mixture is heated for 6 h to 700°C; and
in step (e) the pellets are sintered for 24 h at 900°C.

17. Use of a solid ion conductor as claimed in any of claims 1 to 11 in batteries, accumulators, supercaps, fuel cells, sensors and/or electrochromic devices such as windows, screens and facades.

18. Use as claimed in claim 18, wherein the solid ion conductor is used in the form of pellets, as a thin layer, in a crystalline or amorphous form.